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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/603,124

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Martin David Tillin

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10/05/2004

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EXAMINER

SCHECHTER, ANDREW M

ART UNIT

PAPER NUMBER

2871

DATE MAILED: 10/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/603,124	TILLIN ET AL.	
	Examiner	Art Unit	
	Andrew Schechter	2871	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 25-32 is/are allowed.
- 6) ☒ Claim(s) 1-16, 33 and 34 is/are rejected.
- 7) ☒ Claim(s) 17-24 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 June 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claim 21 is objected to because of the following informalities: it appears that claim 21 should depend on claim 20, rather than on claim 11. Appropriate correction is required.
2. Claim 19 is objected to because of the following informalities: the limitation of claim 19 is inconsistent with that of claim 17, from which it depends; it appears that claim 19 should depend on claim 16 instead. Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-4, 13, 14, 16, 33, and 34 are rejected under 35 U.S.C. 102(b) as being anticipated by *Kuo*, U.S. Patent No. 5,886,754.

Kuo discloses [see Fig. 4a, for instance] a polarization rotator for rotating a polarization direction of linearly polarized input light by an angle γ different from 90°, comprising a first alignment surface [for LC1], a second alignment surface [for LC2], a layer of liquid crystal material having a liquid crystal director and being disposed

between the said alignment surfaces, said rotator having a mode in which a 90° twist of said liquid crystal director is induced across said layer [col. 3, line 46ff.], the layer having a retardation of $\Delta n \cdot d = 0.085 \cdot 3 \mu\text{m} = 0.255 \mu\text{m}$, so $\Delta n \cdot d / \lambda = 0.46$ for light with $\lambda = 550 \text{ nm}$. The angle between the polarization direction of the input light and an alignment direction of the first alignment surface (called β in *Kuo*) is $\theta = 20^\circ$. Comparing these numbers with Fig. 1 of the specification, with $\gamma = 130^\circ$ or -50° and $\Delta n \cdot d / \lambda = 0.46$, we see that these values fall substantially on the lines given by the set of equations recited in claim 1. Claim 1 is therefore anticipated.

The light is visible light, so claim 2 is also anticipated. There is a further mode in which there is substantially no twist of said liquid crystal director across said layer, so claim 3 is also anticipated. The alignment surfaces induce the 90° twist across the layer [col. 4, line 17], so claim 4 is also anticipated. There is an input polarizer [102] having a transmission axis oriented at $-\theta$ to the alignment direction of the first alignment surface, so claim 13 is also anticipated. There is an output polarizer [also 102] having a transmission [meaning passing light through to the viewer] axis substantially perpendicular to the polarization direction of the input light, so claim 14 is also anticipated. The angle $\gamma = -50^\circ$ satisfies the relation in claim 16, so claim 16 is also anticipated.

Kuo discloses a display and an optical modulator comprising this polarization rotator, so claims 33 and 34 are also anticipated.

5. Claims 1-4, 7, 11, 12, 16, 33, and 34 are rejected under 35 U.S.C. 102(b) as being anticipated by *Wu*, U.S. Patent No. 5,933,207.

Wu discloses [see Fig. 2, for instance] a polarization rotator for rotating a polarization direction of linearly polarized input light by an angle γ different from 90° , comprising a first alignment surface [34], a second alignment surface [38], a layer of liquid crystal material having a liquid crystal director and being disposed between the said alignment surfaces, said rotator having a mode in which a 90° twist of said liquid crystal director is induced across said layer [col. 5, line 10ff.], the layer having a retardation of $\Delta n \cdot d = 0.25 \mu\text{m}$ [col. 5, line 62], so $\Delta n \cdot d / \lambda = 0.45$ for light with $\lambda = 550 \text{ nm}$. The angle between the polarization direction of the input light and an alignment direction of the first alignment surface (called β in *Wu*) is “on the order of 20° ” [col. 5, line 44], so $\theta \sim 20^\circ$. Comparing these numbers with Fig. 1 of the specification, with $\gamma = 130^\circ$ or -50° and $\Delta n \cdot d / \lambda = 0.45$, we see that these values fall substantially on the lines given by the set of equations recited in claim 1. Claim 1 is therefore anticipated.

The light is visible light, so claim 2 is also anticipated. There is a further mode in which there is substantially no twist of said liquid crystal director across said layer, so claim 3 is also anticipated. The alignment surfaces induce the 90° twist across the layer [col. 4, line 12, for instance], so claim 4 is also anticipated. The liquid crystal is nematic with positive dielectric anisotropy [see Fig. 1], so claim 7 is also anticipated. There is an electrode arrangement for selectively applying a field across at least one region of the layer, with an active matrix [col. 6, line 15], so claims 11 and 12 are also anticipated. The angle $\gamma = -50^\circ$ satisfies the relation in claim 16, so claim 16 is also anticipated.

Wu discloses a display and an optical modulator comprising this polarization rotator, so claims 33 and 34 are also anticipated.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 5, 6, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Wu*, U.S. Patent No. 5,933,207 as applied to claim 1 above, in view of *Takano*, U.S. Patent No. 5,249,070.

Wu discloses using alignment (or orientation) layers to induce the twist. *Takano* discloses that such a twist can be induced by either orientation layers or by using a chiral dopant in the liquid crystal layer [see abstract]. It would have been obvious to one of ordinary skill in the art at the time of the invention to use a chiral dopant in the liquid crystal layer to induce the 90° twist instead of orientation layers, motivated by the two being art-recognized equivalents. Claims 5 and 6 are therefore unpatentable.

Wu does not explicitly disclose that substantially equal pre-tilts at the alignment surfaces. *Takano* does disclose substantially equal (in magnitude) pre-tilts at the alignment surfaces [see Fig. 7, for instance]. It would have been obvious to one of ordinary skill in the art at the time of the invention to have substantially equal pre-tilts at the alignment surfaces in *Wu*'s device as done in *Takano*, motivated by *Takano*'s teaching that *Takano*'s structure has very symmetrical contrast for up/down viewing angles [see abstract]. Claim 10 is therefore unpatentable.

8. Claims 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Wu*, U.S. Patent No. 5,933,207 as applied to claim 1 above.

Wu discloses that the liquid crystal is nematic. The examiner takes official notice that positive and negative dielectric anisotropy liquid crystals are both well-known. It would have been obvious to one of ordinary skill in the art at the time of the invention to use either in an LCD such as *Wu*'s, motivated by the art-recognized equivalency of the two. Claims 7 and 9 are therefore unpatentable.

Wu does not disclose that the liquid crystal is smectic. The examiner takes official notice that the use of smectic liquid crystal in an LCD such as *Wu*'s is well-known. It would have been obvious to one of ordinary skill in the art at the time of the invention to do so, motivated by the desire to obtain higher switching speed by using smectic rather than nematic. Claim 8 is therefore unpatentable.

9. Claims 1, 2, 4-6, 11-13, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Kwok et al.*, U.S. Patent No. 6,633,358 in view of *Kikuchi et al.*, U.S. Patent No. 5,745,200.

Kwok discloses [see Fig. 1, and col. 6, line 61 – col. 8, line 31, for instance] a method of determining the twist angle ϕ and retardation $\Delta n \cdot d$ of a liquid crystal cell [5], utilizing a liquid crystal cell's property that it can rotate the polarization of incident light. *Kwok* does not explicitly disclose using the method on a LC cell with alignment surfaces and a 90° twist angle. *Kikuchi* discloses a LC cell with alignment surfaces and a 90° twist angle [see abstract]. It would have been obvious to one of ordinary skill in the art at the time of the invention to use the method of *Kwok* to determine the retardation of

Kikuchi's liquid crystal cell, motivated by the desire to determine the optical properties of the LCD, which "is important both for product development and for quality assurance" [col. 1, lines 15-25 of *Kwok*].

Kwok in view of *Kikuchi* therefore discloses a polarization rotator [the liquid crystal cell, 5] for rotating a polarization direction of linearly polarized input light by an angle γ different from 90° [col. 6, line 61 – col. 7, line 15, and col. 7, line 53 – col. 8, line 31, for instance]. With *Kikuchi's* 90° twist in the LC director, so that the twist angle $\phi = \pm 90^\circ = \pm \pi/2$, equations (6)-(8) in *Kwok* become the set of equations recited in claim 1. In particular, *Kwok's* $\delta = (\pi \cdot \Delta n \cdot d) / \lambda = \pm (\pi/2) \cdot \alpha$, where α is as defined in claim 1's second equation; *Kwok's* equation (6) becomes claim 1's first equation; *Kwok's* $\Psi = \gamma$, where γ is the angle in claim 1 by which the light rotates; and *Kwok's* $\Psi = \phi - 2\alpha^*$ becomes claim 1's third equation where $\theta = -\alpha^*$ is the angle between the polarization direction of the input light (or the axis of polarizer [2]) and an alignment direction of the first alignment surface. Claim 1 is therefore unpatentable.

The wavelength λ is a wavelength of visible light, so claim 2 is also unpatentable. The first and second alignment surfaces induce said 90° twist, so claim 4 is also unpatentable. The liquid crystal has a chiral dopant which also helps induce the twist [col. 8, lines 63-65], so claims 5 and 6 are also unpatentable. There are electrodes of an active matrix [col. 8, line 5], so claims 11 and 12 are also unpatentable. The input polarizer [2 in *Kwok*] has a transmission axis oriented at $-\theta$ to the alignment direction of the first surface, so claim 13 is also unpatentable. There is an output polarizer [3 in

Kwok] having a transmission axis oriented at substantially $(\gamma + n \cdot 90)^\circ$, where n is the integer 0 (zero), so claim 15 is also unpatentable.

Allowable Subject Matter

10. Claims 17-24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

11. Claims 25-32 are allowed.

12. The following is a statement of reasons for the indication of allowable subject matter:

The prior art does not disclose the device of claim 17, in particular the additional limitation that the polarization rotator has the particular values $\gamma = \pm 45^\circ$ and $\Delta n \cdot d / \lambda = 0.487$. Claim 17 would therefore be allowable if rewritten appropriately, as would claim 18 which depends from it.

The prior art does not disclose the device of claim 19, in particular the additional limitation that the polarization rotator has the particular values $\theta = \pm 12.5^\circ$. Claim 19 would therefore be allowable if rewritten appropriately. (Note the objection to claim 19 above, as well.)

The prior art does not disclose the device of claim 20, in particular the additional limitation that the polarization rotator has the particular values $\gamma = \pm 55^\circ$ and $\Delta n \cdot d / \lambda = 0.55$. Claim 20 would therefore be allowable if rewritten appropriately (as would claim 21 which should depend from it, see objection above).

The prior art does not disclose the device of claim 22, in particular the additional limitation that the polarization rotator has the particular range of values $175^\circ \leq |\gamma| \leq 180^\circ$. Claim 22 would therefore be allowable if rewritten appropriately, as would claims 23 and 24 which depend from it.

The prior art does not disclose the device of claim 25, in particular a parallax barrier comprising the polarization rotator recited in the present claim 1. The nearest prior art, *Morishima*, is discussed below. Claim 25 is therefore allowed, as are its dependent claims 26-32.

Conclusion

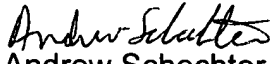
13. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent No. 5,875,055 to *Morishima et al.* [see Figs. 13-14, for instance] discloses a parallax barrier with a polarization rotator [32A] for rotating the polarization direction by an angle different from 90° [45° in this case], but not having a 90° twist angle in the liquid crystal, not having light enter at an angle θ to the first alignment surface, and therefore not satisfying the equations recited in claims 1 and 25 for the retardation.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew Schechter whose telephone number is (571) 272-2302. The examiner can normally be reached on Monday - Friday, 9:00 - 5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert H. Kim can be reached on (571) 272-2293. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


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30 September 2004